Madicken Munk

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Education

University of California, Berkeley
PhD, Nuclear Engineering 2017
Master of Science, Nuclear Engineering 2013
Oregon State University
Bachelor of Science, Nuclear Engineering 2011

Research Interests

computational methods for radiation transport; advanced energy systems; software development for scientific analysis; hybrid methods in radiation transport, mutiphysics methods, multiphysics simulations, including structure/radiation and fluid/radiation interaction; nontraditional applications of nuclear science; energy policy; nuclear policy; open science, data accessibility

Research Experience

University of Illinois, Urbana Champaign Fall 2017 – present

- *Postdoctoral Research Associate, National Center for Supercomputing Applications, Data Exploration Laboratory*: My postdoctoral work focuses on developing open source tools for visualization of large datasets, including nuclear engineering. [**Python, Rust, WebAssembly, yt visualization toolkit**]

UC Berkeley Department of Nuclear Engineering August 2011 to Fall 2017

- Developed hybrid deterministic / Monte Carlo transport method to reduce variance reduction in shielding problems with strong angular anisotropy. (*Collaboration with ORNL*) [**Denovo S_N, MCNP, Advantg, Python**]
- Design of a neutron source for in-situ irradiation of geological samples for $^{40}Ar/^{39}Ar$ geochronology of Martian samples. **(***Collaboration with Scottish Universities Environmental Research Centre (SUERC) and Berkeley Geochronology Center (BGC)*). [**MCNP, Python**]
- Computed radiation-induced swelling of graphite reactor core components in a Fluoride Salt-Cooled High Temperature Reactor (FHR) for component lifetime evaluation. [**MCNP, COMSOL, Matlab**]
- Designed a fluoride salt-cooled high temperature test reactor (FHTR) reactor core to match reactor physics parameters of a larger FHR design. [**MCNP, ORIGEN**]

Oregon State University Radiation Center June 2008 to August 2011

- Calculated Molybdenum-99 production in the Oregon State TRIGA reactor from specifically designed targets. [**MCNP, Matlab**]
- Verification of Reed College reactor for updated Safety Analysis Report and license renewal. [**MCNP**]

Publications, Presentations and Patents

Peer-Reviewed Journals

- **Munk M.**, Slaybaugh, R.N., "Review of Hybrid Methods for Deep-Penetration Neutron Transport", Nuclear Science and Engineering (Accepted)

- Morgan, L., **Munk M.**,Davidheiser-Kroll, B., et al., "Instrumentation Development for planetary in-situ $^{40}Ar/^{39}Ar$ Geochronology," Geostandards and Geoanalytical Research 41 (3), 381-396, 2017
- Andreades, C., Cisneros, A.T., Choi, J.K., Chong, A.Y., Fratoni, M., Hong, S., Huddar, L.R., Huff, K., Kendrick, J., Krumwiede, D.L., Laufer, M., **Munk, M.**, Scarlat, R.O., Wang, X., Zwiebaum, N., Greenspan, E. and P. Peterson. "Design Summary of the Mark-I Pebble-Bed, Fluoride SaltCooled, High-Temperature Reactor Commercial Power Plant," Nuclear Technology, vol. 195, no. 3, pp. 222-238, Sep. 2016.

Peer-Reviewed Publications (In Preparation)

- **Munk M.**, Slaybaugh, R.N., et al., "The FW/CADIS-Omega Methods: Characterization and Results for Anisotropic Shielding Scenarios" (anticipated submission early 2019)
- **Munk M.**, Slaybaugh, R.N., et al., "Anisotropy Metrics for Characterization of FW/CADIS-Omega Methods" (anticipated submission 2019)
- Goss, V., **Munk M.**, Slaybaugh, R.N., "The FW/CADIS-Omega Methods Performance Analysis in Large Application Problems" (anticipated submission 2020)

Conference Proceedings

- **Munk, M.,** "yt for georeferenced data", CARTO Spatial Data Science Conference, Brooklyn, NY, October 2018
- **Munk, M.,** Claussen, N., Turk, M., "Leveraging Jupyter, Rust, and WebAssembly for Browser-Based Visual Data Exploration", Scipy 2018, Austin TX, July 13, 2018
- **Munk, M.**, Slaybaugh, R. N., "FW/CADIS-Omega: An Angle-Informed Method for Deep-Penetration Radiation Transport", PHYSOR 2016, Sun Valley, ID, May 2016.
- **Munk, M.**, Morgan, L., Davidheiser-Kroll, B., et al., "Design and Feasibility Study of a Compact Neutron Source for Extra-terrestrial Geochronology Applications", Joint International Conference on Mathematics and Computation (M&C), Nashville, TN, April 2015.
- **Munk, M.**, Morgan, L., Davidheiser-Kroll, B., et al., "Instrumentation Development for planetary in-situ $^{40}Ar/^{39}Ar$ Geochronology", American Nuclear Society Winter Meeting, Reno, NV, November 2014.
- Morgan, L., Davidheiser-Kroll, B., **Munk M.**, et al., "Instrumentation Development for planetary in-situ $^{40}Ar/^{39}Ar$ Geochronology", Goldschmidt Conference June 2014.
- **Munk, M.**, "Use of Comsol Multiphysics for the Evaluation Of Radiation-Induced Stresses in the PB-FHR", American Nuclear Society Student Conference, State College, PA, April 2014.
- **Munk, M.**, Cisneros, A. T., Greenspan, E., Peterson, P.F., "Preliminary Design of a FHR Test Reactor Core", American Nuclear Society Annual Meeting, Chicago, IL, June 2012.
- **Munk, M.**, "Optimization of Molybdenum-99 Production in Oregon State TRIGA Reactor", American Nuclear Society Student Conference 2010.
- **Munk, M.**, "Production of Medical Isotope in Oregon State University TRIGA Reactor", poster presentation. 1st International Nuclear Energy Conference, Warsaw, Poland, April 2011.

Technical Reports and Whitepapers

- Cisneros, A., et al., "Fluoride-Salt-Cooled, High-Temperature Reactor (FHR) Methods and Experiments Program White Paper." UCBTH-12-002, Department of Nuclear Engineering, UC Berkeley (2013).
- Cao, G., et al., "Fluoride-Salt-Cooled, High-Temperature Reactor (FHR) Materials, Fuels and Components White Paper." UCBTH-12-003, Department of Nuclear Engineering, UC Berkeley (2013).
- Carpenter, D., et al., "Fluoride-Salt-Cooled, High-Temperature Reactor (FHR) Development Roadmap and Test Reactor Performance Requirements White Paper." UCBTH-12-004, Department of Nuclear Engineering, UC Berkeley (2013).

Patents

- "Molybdenum Production in a Low-Power Reactor", Palmer, T.S., Reese, S., Keller, S.T., **Munk, M.**, application submitted July 2010.

Invited Talks

PyData Ann Arbor, Jupyter Widgets with Rust and WebAssembly, talk — March 13, 2019
ASPP, Australian National University, faculty — January 20-27, 2019
University of Illinois, Urbana-Champaign, Nuclear Engineering, seminar — September 26, 2017
University of Tennessee, Knoxville, Nuclear Engineering, seminar — October 19, 2016
Oak Ridge National Laboratory, RNSD, seminar — July 21, 2016

Scholarships, Fellowships, and Awards

- ANS Best Graduate Paper Award, Student Conference — Spring 2014
- Outstanding Graduate Student Instructor Award — 2013-2014
- UC Regents Fellowship, UC Berkeley — 2014, 2015
- NRC Fellowship, UC Berkeley — 2011-2012
- DOE NEUP Scholarship Awardee — 2010-2011
- Karena Dokken Memorial Scholarship Recipient — Spring 2010
- Awarded NRC Scholarship by OSU department of NE/RHP — Fall 2009
- Awarded National Academy for Nuclear Training Scholarship — Summer 2009
- Grund Memorial Scholarship Awardee — Fall 2009
- DOE NEUP Scholarship Awardee — 2009-2010
- Intel Scholar — Summer 2008

Mentorship Experience

Elisha Ham (2018-2019) – NCSA/UniHigh collaboration, mentored Elisha to develop exploratory data analysis application for seismic acoustic and vibration data. tools: git, github, idyll, javascript

Garrett Baltz (2015-2016) – facilitated the creation and development of dry cask storage input files for both SCALE 6.2b and MCNP. Helped to develop independent research project relevant to Garret's individual interests. tools: git, SCALE 6.2b, MCNP, ADVANTG

Nuclear Engineering Discussions (NEDS) – lecture series sponsored by Alpha Nu Sigma, co-developed lecture material, problems, and discussion topics for a 10-week voluntary seminar for lower-level undergraduates.

Mentors and Mentees – co-founder of undergraduate peer mentoring program for undergraduate students. Helped organize events to promote networking between students in engineering.

Teaching Experience

Engineering Teaching

CSE Interactive Fridays, *git and github* — Fall 2018, Spring 2019
- Developed custom interactive lecture material for Computational Sciences and Engineering Department, covering interactive *git* and *github*

ENG 198, Engineering Grand Challenges — Fall 2018
- Prepared a lecture on nuclear energy and how it can be leveraged to address several of NAE's grand challenges

NE 155, Introduction to Numerical Simulations in Radiation Transport — Spring 2014
- Graduate Student Instructor: held office hours, led midterm review sessions, graded homework assignments, lectured for two class hours

NE 250, Nuclear Reactor Theory — Spring 2012
- Graduate Student Instructor: held office hours, led midterm and weekly review sessions, graded homework assignments and exams, helped develop exam and homework questions

NE 101, Nuclear Reactions and Radiation — Fall 2011, 2014
- Graduate Student Instructor: held office hours, led weekly review lectures, graded homework assignments and exams
- Awarded "Outstanding Graduate Student Instructor Award"

Scientific Computing Teaching

Advanced Scientific Programming in Python (ASPP) Jan 20-27, 2019
- git/github, numpy

University of Illinois, Urbana Champaign Feb 07-08, 2019
- The Bash shell, Git/GitHub for beginners, Software Carpentry Workshop

University of Illinois, Urbana Champaign September 20-21, 2018
- The Bash shell, Software Carpentry Workshop

University of Illinois, Urbana Champaign July 31 2018
- Data Management, Git/Github for beginners, CropsInSilico Workshop

University of Illinois, Urbana Champaign February 02 2018
- the bash shell, Software Carpentry Workshop

University of Illinois, Urbana Champaign September 21-22, 2017
- The Unix Shell, Software Carpentry Workshop

University of Illinois, Urbana Champaign August 31-September 01, 2017
- The Unix Shell, Software Carpentry Workshop

Lawrence Berkeley National Laboratory August 17 2016
- Git/Github for beginners, Software Carpentry Workshop

Service

- Member, Technical Program Committee, ANS Mathematics and Computation (M&C) 2019
- Mini-Symposia Co-Chair *Science Communication Through Visualization*, SciPy 2019
- Member, Carpentries Curriculum Advisory Committee (2018-present)
- Maintainer, *Version Control With git*, Carpentries lesson (2018-present)
- Co-chair, Assessment Subcommittee, Committee on Diversity and Inclusion in Scientific Computing, NumFOCUS (2018-present)
- Vice President of University of California, Berkeley Chapter of Alpha Nu Sigma, 2013-2015
- President of Oregon State University student American Nuclear Society chapter, 2011-2012
- Secretary of Oregon State University student American Nuclear Society chapter, 2009-2011
- Member of Alpha Nu Sigma, Nuclear Engineering Honors Society, inducted May 2011
- President of Mentors and Mentees, an undergraduate peer-mentoring program at OSU 2009-2011
- College of Engineering Ambassador, Oregon State University 2008-2011

Skills

Software Packages	*Languages*	*Other Skills*
MCNP	Python 2 and Python 3	LaTeX
Denovo S_N	bash	git/github
Scale	Rust	make / CMake
Advantg	Matlab	HPC systems
COMSOL Multiphysics	C++ (experience, not proficiency)	HDF5
Origen		GoogleTest
		Travis CI/Appveyor